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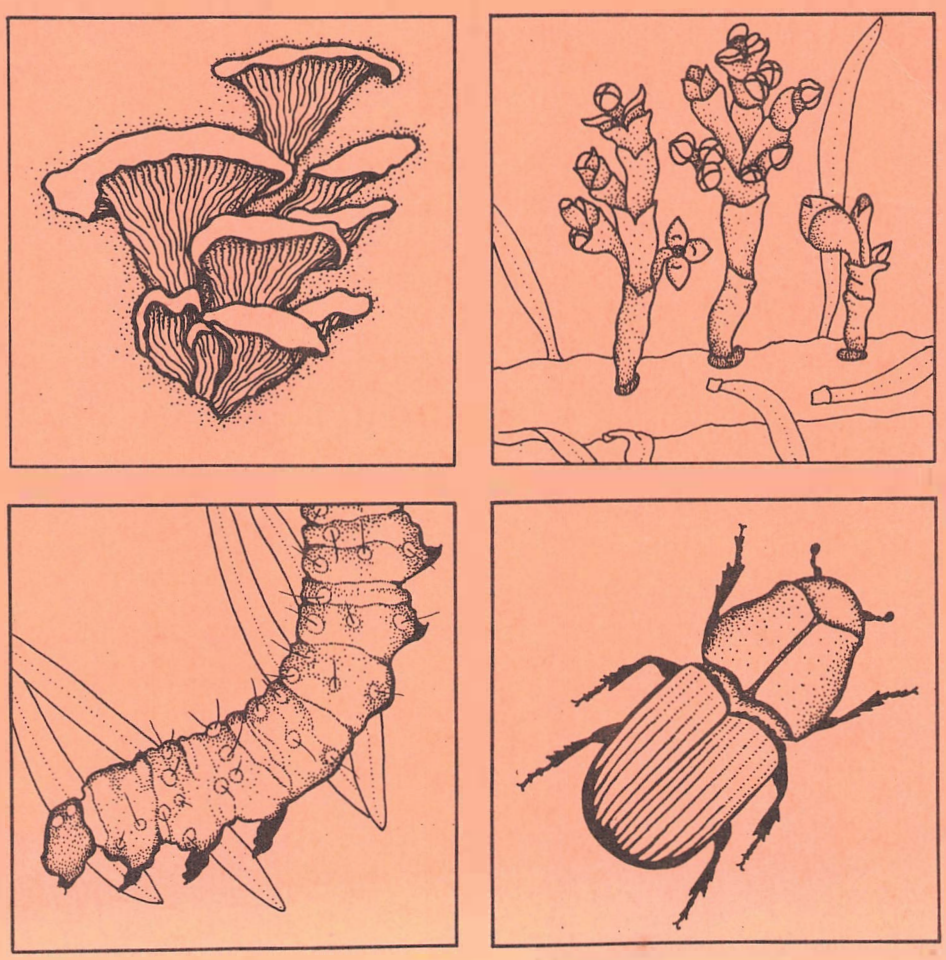
Evaluation of a Mountain Pine Beetle Infestation in Second Growth Ponderosa Pine

on the Crow Indian Reservation, Montana, 1979

by K.E. Gibson, M.D. McGregor and J.E. Dewey



EVALUATION OF A MOUNTAIN PINE BEETLE INFESTATION IN SECOND-GROWTH PONDEROSA PINE ON THE CROW INDIAN RESERVATION, MONTANA, 1979

by

K. E. Gibson, M. D. McGregor, and J. E. Dewey 1/

ABSTRACT

The mountain pine beetle infestation in Corral, Little Corral, and Cache Creeks on the Crow Indian Reservation, Montana has been increasing for the past several years. Trees killed per acre averaged 38.8 in 1979. Our predictions for the future trend of the infestation, plus management alternatives to lessen its severity, are outlined in this report.

INTRODUCTION

The mountain pine beetle 2/, for nearly two decades, has been reinforcing its reputation as the most destructive pest of native pines in the western United States. While the millions of lodgepole pine killed throughout Utah, Idaho, Montana, and Wyoming are legend, the beetle has also had a devastating effect on second-growth ponderosa pine 3/ stands

1/ Forest Service, Northern Region, State and Private Forestry, Missoula, Montana

2/ *Dendroctonus ponderosae* Hopkins

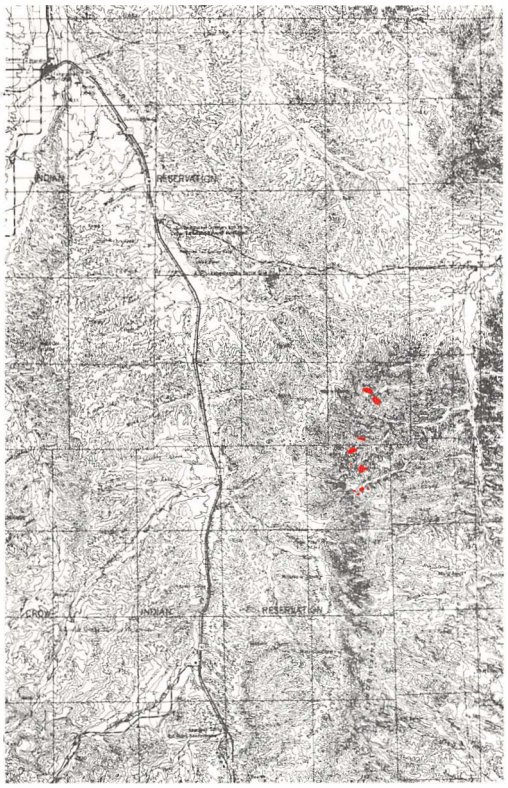
3/ *Pinus ponderosa* Laws

in the West. Particularly hard hit have been 50- to 100-year-old ponderosa pines in the Pacific Northwest, the Black Hills of South Dakota, and the Front Range in Colorado (Sartwell and Stevens, 1975). In Montana, serious losses have occurred in some areas throughout the past 10 years. Annual aerial detection surveys indicated in 1972 approximately 4,300 acres of second-growth ponderosa pine State-wide were infested by the mountain pine beetle during 1971. Tree mortality was estimated at 4,400 trees--roughly one tree per acre. Since that time, beetle populations have fluctuated, but generally risen throughout susceptible ponderosa stands in the State. Current year estimates show more than 34,000 trees killed on about 44,000 acres (figure 1). Though mortality on a tree-per-acre basis is approximately the same, there has been a tenfold increase in infested acres. And some particularly vulnerable stands are experiencing a much higher mortality rate. 4/ Tree killing was first detected in the Corral, Little Corral, and Cache Creek drainages of the Wolf Mountains on the Crow Indian Reservation in 1971 (McGregor, Kohler and Ferry, 1974). Ground surveys conducted in November 1973 showed 1971 tree mortality attributable to the mountain pine beetle was 5.1 trees per acre. A followup survey in that same area in October 1977 indicated that during 1977 an average of 27 trees per acre were killed. Following beetle attack in 1979, we conducted an evaluation to update our knowledge of the beetle's status and to determine its population trend. This report includes survey findings and subsequent recommendations for stand management which can lessen the severity of the infestation.

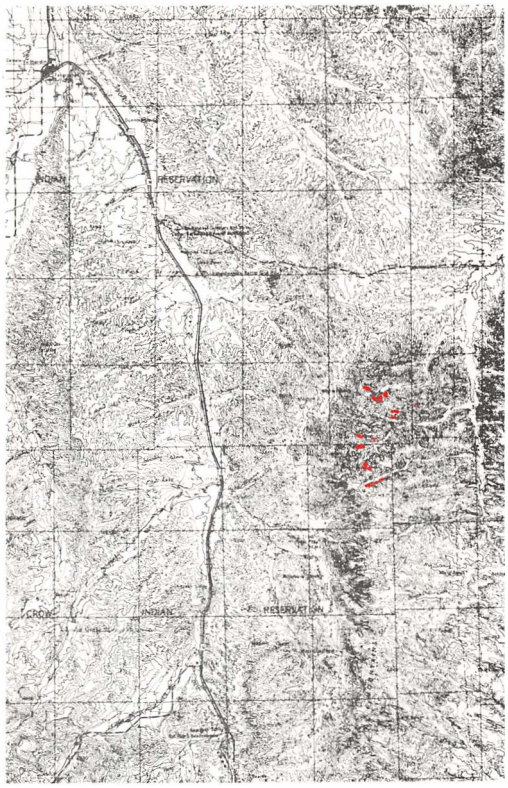
SURVEY METHODS

Using a current aerial survey map to locate areas of faded trees (those killed in 1978), we established survey sites at three locations in August 1979: Corral Creek, Little Corral Creek, and Cache Creek (figure 1-h). At each site, a compass line was determined which would randomly transect the infestation. Beginning at a random point, usually two chains from a road or other opening, we established a variable radius (basal area factor 20) plot at each 5-chain interval along the transect. At each plot location we recorded all "in" trees according to species, diameter at breast height, and damage class for host trees. Damage classification included uninfested, current attack, previous year attack (fader), older dead (snag), strip attack, unsuccessful attack (pitchout), and other or unknown mortality. Heights of the first two trees of each species were measured for volume estimations. In addition, regeneration data were accumulated from 1/300-acre plots taken at each plot center. Data were analyzed using the computer program INDIDS (Bousfield, 1977).

4/ Unpublished data. Northern Region Office Files, Missoula, MT



a. 1972



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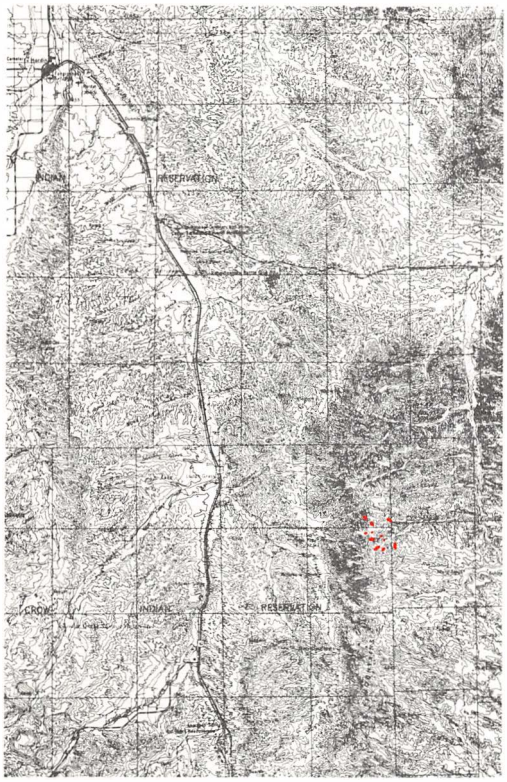
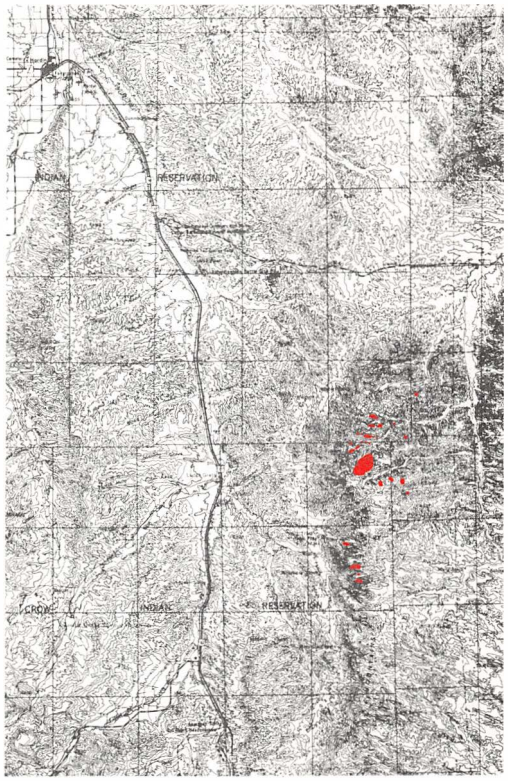
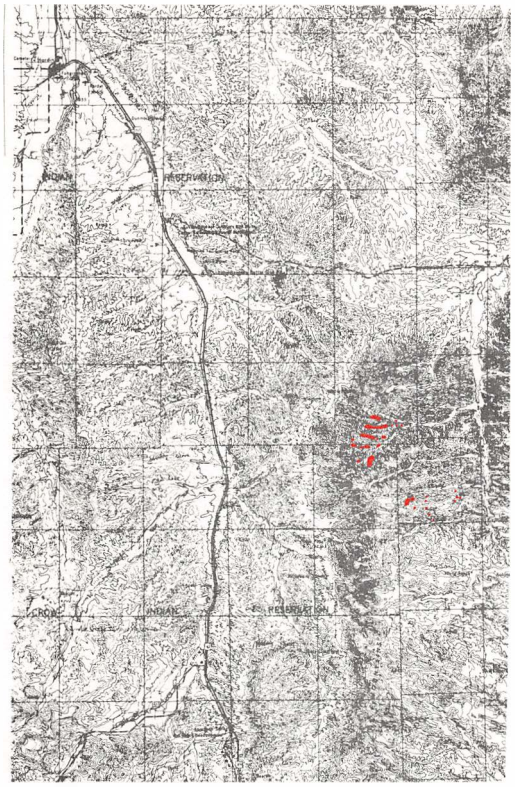


c. 1974

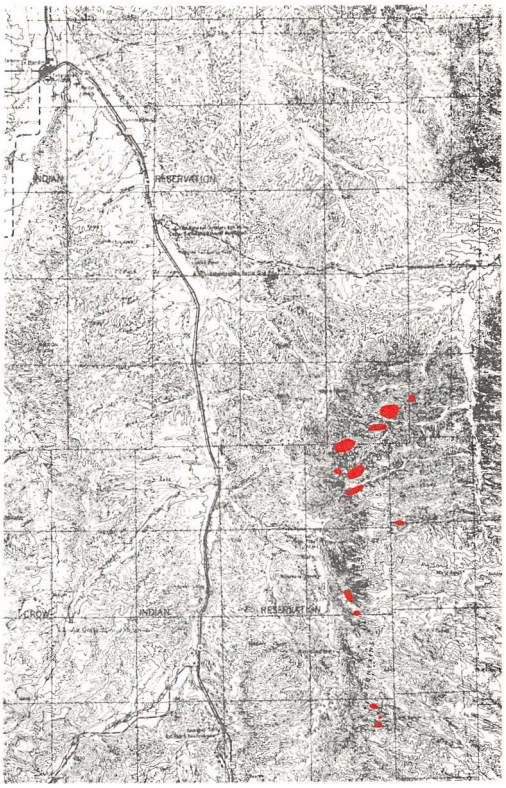


d. 1975

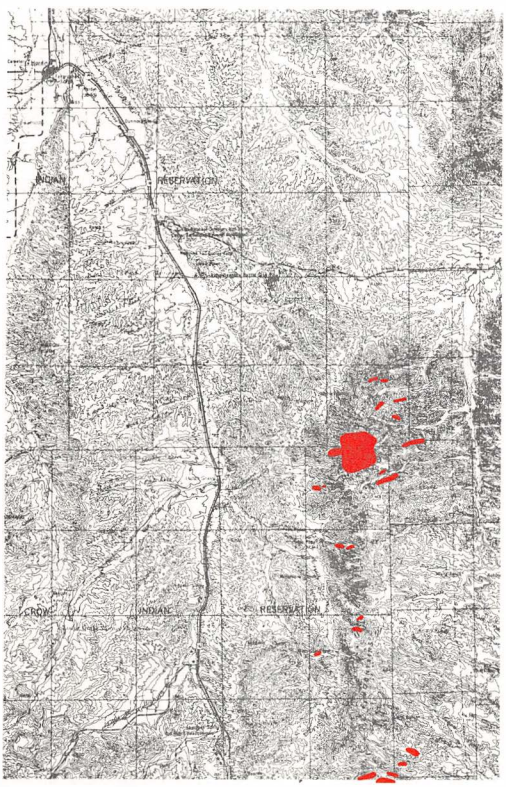
Figure 1.--Mountain pine beetle infestations recorded from aerial detection surveys on Crow Indian Reservation, Montana, 1972-79.



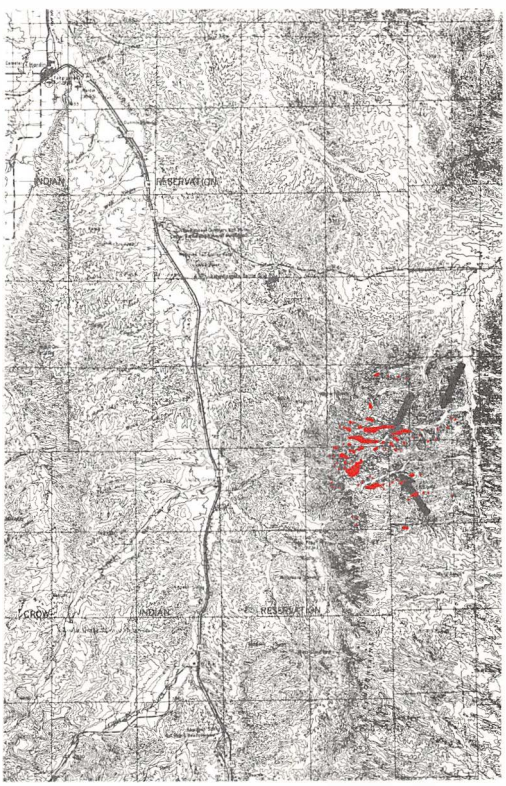
e. 1976



f. 1977



g. 1978



h. 1979

Figure 1 (continued).-- Arrows (h) denote location of ground survey plots.

RESULTS

Results of the evaluation are found in tables 1 and 2. Newly attacked trees per acre averaged 73.0 on Corral Creek, 5.6 on Little Corral Creek, and 37.9 on Cache Creek. Overall average was 38.8 new attacks per acre.

Table 1.--Mountain pine beetle mortality at three locations on the Crow Indian Reservation, Montana, August 1979.

Diameter class	Uninfested	Current attack	Previous year attack	Older dead
		CORRAL CREEK		
0-4.9	180.0	0	0	0
5-11.9	119.8	55.5	6.2	9.5
12 +	49.2	17.5	10.2	18.4
Total	349.0	73.0	16.4	27.9
		LITTLE CORRAL CREEK		
0-4.9	180.0	0	0	0
5-11.9	181.5	0	0	0
12 +	72.5	5.6	1.2	0
Total	434.0	5.6	1.2	0
		CACHE CREEK		
0-4.9	120.0	0	0	0
5-11.9	123.4	6.3	0	3.1
12 +	69.6	31.6	4.7	4.6
Total	313.0	37.9	4.7	7.7

Table 2.--Accumulative mountain pine beetle mortality from 30 variable radius plots, Crow Indian Reservation, Montana, August 1979.

Location	Uninfested 1/	Current 1/ attack	Previous year 1/ attack	Older dead 1/
Corral Cr.	169.0	73.0	16.4	27.9
L. Corral Cr.	254.0	5.6	1.2	0
Cache Cr.	193.0	37.9	4.7	7.7
Plot $\bar{X}$	205.3	38.8	7.4	11.8

1/ Represents ponderosa pine $\geq$ 5" d.b.h.

DISCUSSION

Though there is an apparent disparity in mortality between the three areas surveyed, the data does show to what extent tree killing is possible. In Corral Creek, where mortality is highest, the fewest number of merchantable trees remain alive. Conversely, Little Corral Creek, which has the lowest current mortality, has more green trees in the larger diameter classes than either of the other areas. We predict that the number of trees killed will increase markedly in Little Corral Creek in the next few years. Our surveys indicate that while Little Corral Creek has the potential for the greatest future mortality, all areas surveyed will probably experience additional tree killing.

Sartwell and Stevens (1975) have identified stand conditions usually associated with mountain pine beetle outbreaks in ponderosa pine as:

1. Species composition: pure or nearly pure ponderosa pine.

2. Stand structure: essentially even-aged.

3. Stand age: 50 to 100 years.

4. Tree size: 8 to 12 inches d.b.h.

5. Stand density: Stem basal area generally in excess of 150 square feet/acre.

Comparing composite data from the three areas surveyed on the Reservation, we find:

1. Species composition: 100 percent ponderosa pine.

2. Stand structure: even-aged.

3. Stand age: 80-100 years.

4. Tree size: average d.b.h. = 12 inches; 205 trees per acre over 5", 63 trees per acre over 12".

5. Stand density: 133 square feet/acre.

These stand parameters indicate that if those stands remain unmanaged, many more trees will be killed in the near future. As beetle populations build, more trees will be killed yearly until virtually all susceptible trees have been removed. Figure 2 illustrates the population trend of the beetle on the Crow Indian Reservation since 1972. Without man's intervention, and barring severely cold winters, the curve will continue its upward trend in the next several years.

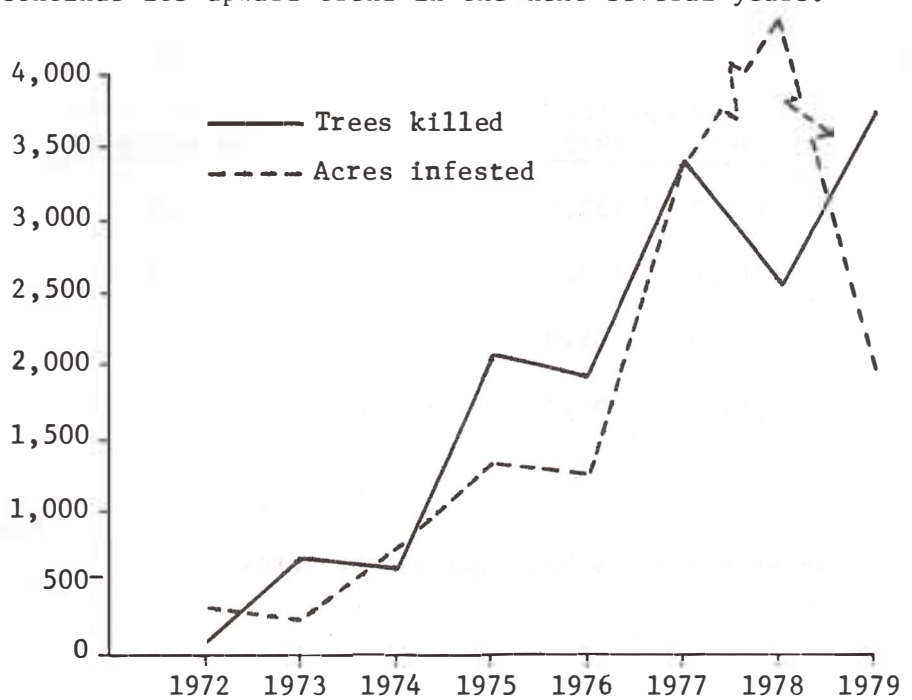


Figure 2.--Mountain pine beetle trend, Crow Indian Reservation, Montana. (Data based on annual aerial detection surveys.)

The "Acres infested" curve in figure 2 seems to indicate a decreasing trend, while the "Trees killed" curve is still rising. This simply indicates that tree killing is being confined to more dense stands on fewer acres. As larger, more sparsely grown trees are removed, the beetle increasingly concentrates attacks in smaller ones. Ultimately, trees being attacked are too small to provide population increases, and the beetle's numbers decrease to endemic levels.

MANAGEMENT ALTERNATIVES

Land managers now have the option to reduce beetle populations through sound management practices. Those stand conditions most conducive to beetle buildups have been previously listed in this report. Sartwell and Stevens (1975) further stated that the thinning of overstocked second-growth ponderosa pine stands had a profound effect upon beetle-caused tree mortality. Their data, summarized in table 3, shows several thinning strategies in a 55-year-old pole stand on a fairly poor (Site Index 43-70) site. More tree killing by the beetle was exhibited in the unthinned than in the four thinned stands combined--even though each of the five stands were approximately the same size.

Table 3.--Mountain pine beetle mortality 5 years after thinning.

Thinning treatment	Stand density 1967	Stand density 1972	Mountain pine beetle mortality
Unthinned	173.2 1/	152.5 1/	11.8 1/
12 x 12 ft	116.8	113.5	3.2
15 x 15 ft	85.8	89.0	0.2
18 x 18 ft	61.8	64.8	0.0
21 x 21 ft	35.0	37.2	0.0

1/ All figures in stem basal area, square feet/acre.

Their study also showed a positive net growth in the thinned stands. In an additional test, Sartwell and Dolph (1976) stated, ". . . silvicultural thinning reduced killing of Pinus ponderosa pole timber by Dendroctonus ponderosae by more than 90 percent and led to positive net stand growth in an eastern Oregon test."

Stevens et al. (1974), have shown that thinning stands to maintain stand density well below 150 square feet/acre has been effective in suppressing bark beetle outbreaks in the Black Hills. They found that "thinning to open stands and stimulate growth should be ... helpful ... as a deterrent to bark beetle outbreaks." Griffin (1975), citing results of a cooperative FIDM-Lolo NF study, stated that beetle-caused mortality was higher where stand density exceeded 120 square feet/acre in sample plots on Ninemile RD, Lolo NF, MT.

Cautions are issued, however, where thinning is used to manage beetle populations. First, thinning has no application where trees are in a fringe area and are already widely spaced. Second, thinning a small stand may not be successful if the stand is surrounded by unthinned, beetle-infested stands. Finally, slash must be piled and burned, or lopped and scattered, to prevent population buildups of pine engraver beetle (Ips spp.). Where limbs or tops over 3" diameter are left, beetles may develop and then infest surrounding green trees.

Lastly, Stevens et al. (1974), have outlined a timetable for a management program to minimize losses to the beetle when an infestation is underway. The tasks and their estimates of the time necessary to accomplish them are as follows:

Year	Tasks
1	A. Determine boundaries of area to be included and arrange for handling it as a unit.
	B. Salvage infested trees over entire area.
	C. Locate areas in which thinning is needed; begin thinning to about a basal area of 80 square feet per acre.
2	A. Continue salvage.
	B. Finish thinning.
3	Salvage.
4 +	Maintain surveillance. Salvage if needed.
10 +	Reevaluate treated area. Thin where necessary to maintain low stand density.

Using these guidelines, they estimate it will probably take at least 3 years to sufficiently implement the program to significantly reduce beetle losses.

One final note: Unless the thinned and salvaged trees can be sold, management of the beetle will not come cheaply. Still, the land manager must realize that unless he manages his overstocked stands, the beetle will. It is for him to consider carefully the pertinent biologic, economic, social, and political factors of each stand, and then determine his best course of action.

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